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RESEARCH

The Influence of Calcium Dosage Increase on Blood Pressure in Pregnant Mothers In Dr. M. Djamil Hospital Padang

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Abstract

Until recently, the exact etiology and pathophysiology of preeclampsia have not been discovered yet, but based on the clinical symptoms and the defect that appeared, researchers submitted some ways as assumption or as early detection of preeclampsia and eclampsia. Some researchers have suggested the examination of calcium / creatinine excretion ratio in urine from preeclampsia patients as the result of kidney's function changes. This study has been performed with a pre and post test group design experimental method at Obstetric and Gynecology Polyclinic in RS. Dr. M. Djamil Padang and several midwife private practices in Padang since July 2013 until the samples reached the quantity up to 40 samples. Analysis has been done to describe the relationship between calcium intake and blood pressure. Furthermore, we analyzed the differences of systolic - diastolic and MAP before and after calcium intake. Data has been shown on the table and analyzed by Pearson correlation, Wilcoxon test and Paired T test. if p <0.05, it shows a significant result. The mean of systolic after calcium intake was the same for both of the groups (121.5 + 8.02: 121.5 + 6.71). Mean of diastolic after calcium intake in controls group was lower than trials group (75.9 + 4.32: 75.9 + 4.32). Mean of MAP after calcium intake for controls group was lower that trials group (91,088 + 4.47: 91,956 + 6.08). There is an influence of calcium intake on decreasing maternal blood pressure. The mean of systolic after calcium intake was the same for both of the groups (121.5 + 8.02: 121.5 + 6.71). Mean of diastolic after calcium intake in controls group was lower than trials group (75.9 + 4.32: 75.9 + 4.32). Mean of MAP after calcium intake for controls group was lower that trials group (91,088 + 4.47: 91,956 + 6.08). There is an influence of calcium intake on decreasing maternal blood pressure. The mean of systolic after calcium intake was the same for both of the groups (121.5 + 8.02: 121.5 + 6.71). Mean of diastolic after calcium intake in controls group was lower than trials group (75.9 + 4.32: 75.9 + 4.32). Mean of MAP after calcium intake for controls group was lower that trials group (91,088 + 4.47: 91,956 + 6.08). There is an influence of calcium intake on decreasing maternal blood pressure.

Keywords: *Systolic, Diastolic, Mean Arterial Pressure (MAP)*

INTRODUCTION

Severe preeclampsia and eclampsia are a group of symptoms that can occur in pregnancy and childbirth. These changes need to be recognized properly, because the effects they cause are problems that also determine the welfare and safety of the mother and the fetus they contain. The reported incidence of severe preeclampsia and eclampsia varies greatly. Savitz and Zhang, who conducted research in North Carolina (USA), found the incidence of hypertension in pregnancy of 43.1 per 1000 single pregnancies.[1]

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The World Health Organization (WHO) recorded an incidence of severe preeclampsia ranging from 0.51% to 38.4%. While the incidence of severe preeclampsia in Indonesia ranges from 3% -10%. Data from medical records of patients treated in Obstetrics and Gynecology Hospital Dr. DR. M. Djamil Padang during the period January 1, 2011 to December 31, 2011 found 125 patients with severe preeclampsia (8.31%), 13 cases of eclampsia, and 2 of them died from 1395 deliveries.[2]

Given the high incidence of preeclampsia, it is important to be able to detect this condition early so that maternal and perinatal morbidity and mortality as a result can be reduced. With early detection it is hoped that interventions can be carried out on the course of the disease so that it does not cause adverse effects on the welfare of the mother and fetus.[3,4]

Until now, the etiology and pathophysiology of preeclampsia is not known with certainty, but based on the symptoms and the damage it causes, the researchers propose various methods both as estimators and for early detection of preeclampsia and eclampsia.5,6 More than 100 clinical, biophysical examinations and biochemistry has been proposed for this purpose, but the results are often inconsistent or even contradictory. This is due to the non-uniformity of the population studied, the definition of preeclampsia used and the way to state the results. In general, the available methods of estimating preeclampsia can be classified into 5 the large group is standard examination during antenatal period, vascular system examination, biochemical examination, hematological examination and ultrasonographic examination. The ideal examination must be simple and easy to do, does not take long, is noninvasive and has a high sensitivity and positive predictive value.[5,6]

Measurement of blood pressure as the easiest method has been widely used, but in fact there are weaknesses in this method. Mother's activity, measurement time position and which arm was used turned out to have a considerable influence on the difference in measurement results. Some other methods of examination that are also commonly used such as the sloping sleep test, weight weighing and urine protein testing also apparently cannot always be used as a predictor of preeclampsia.7 Based on that, some researchers recommend other methods of examination, one of which is the examination of calcium excretion ratio / creatinine in urine to suspect the incidence of preeclampsia. The basis of this examination is a change in the ratio of calcium / creatinine excretion in urine in patients with preeclampsia due to changes in kidney function. Lately, it seems that this inspection method has begun to be carried out, because the method is simple and easy to do, noninvasive, relatively inexpensive and gives pretty good results.[5,6]

Deviations of calcium homeostasis have long been known to occur in hypertension in general and especially in preeclampsia. The kidneys play an important role in calcium

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metabolism, where their function changes, both in normal pregnancies and in preeclampsia.[4,7,8] Calcium excretion through the kidneys increases during normal pregnancy.

In normal pregnancy calcium excretion is 350-620 mg / day compared to 100-250 mg / day in women who are not pregnant. This excretion increases in each trimester with maximum excretion achieved during trimester III.[9] Increased calcium excretion in advanced pregnancy is a consequence of the increased glomerular filtration rate (GFR) that occurs in pregnancy normal.[8,9] During normal pregnancy, renal blood flow and GFR increase. With hypertension in pregnancy, renal perfusion and glomerular filtration will decrease. The greater the rate of decline, the more severe the disease. This situation is the cause of hypokalsiuria in patients with preeclampsia.[10,11]

Calcium excretion occurs in feces and urine. Every day more than 5/6 parts of calcium intake are excreted in faeces, and the remaining 1/6 is excreted in urine. Urine calcium levels can be measured by the Cresolphtalein-complexone method using the Microlab 300 machine, normal morning urine calcium values: 6.7 - 20 mg / dl. If creatinine levels are measured by the Jaffe method, using a Microlab 300 machine, the normal creatinine value of morning urine: 40-120 mg / dl. Because creatinine levels in the urine are almost constant, so the concentration of other substances in the urine is always compared to creatinine levels. That way the amount of excretion of certain metabolites is said to be "gram per gram creatinine". Thus the normal value of the urine creatinine calcium ratio is above 0.056.

Rodriguez et al. conducted a study to measure the ratio of calcium excretion to urine creatinine levels taken in the morning from 88 normotensive pregnant women 24-34 weeks' gestation. From this study it was found that the ratio of excretion of calcium and creatinine urine which is smaller or equal to 0.04 gives a sensitivity of 70%, a specificity of 95%, a positive predictive value of 64% and a negative predictive value of 96% to suspect the possibility of preeclampsia.[8]

Dasgupta and colleagues (2012) conducted a study on the assessment of the effectiveness of normative urinary calcium examination in pregnant women with normotensive and preeclampsia, statistically, the ratio of urine creatinine calcium decreased significantly at 28 to 40 weeks' gestation.[12]

Based on Sabaruddin F's research, in 2006 about the relationship of systolic blood pressure and urine creatinine calcium ratio in pregnant women 16-20 weeks with the incidence of preeclampsia, the probability of the occurrence of preeclampsia / eclampsia is based on the calcium ratio group creatinine <0.058 and systolic blood pressure 120-1 139 mmHg, 35.7 times greater than the creatinine calcium ratio> 0.058 and systolic blood pressure <120 mmHg.[13]

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Bearing this in mind, the authors wish to continue the preliminary research in Dr. M. Djamil Padang, by giving calcium supplements every day until term pregnancy and assessing whether there is an effect of increasing calcium doses on the increase in blood pressure.

METHOD

This research was conducted with an experimental method of pre and post test group design in Polycilinic Obgin Hospital. Dr. M. Djamil and midwife private practice in the city of Padang starting in July 2013 until the number of samples met 40 people were sampled. The analysis was carried out to describe the relationship between calcium administration and blood pressure. Then an analysis of differences in diastolic systolic and MAP before and after administration of calcium tablets. Data is presented in tabular form. Data were tested by Pearson correlation and Wilcoxon test and Paired T-Test. If p <0.05 shows meaningful results.

RESULTS

Had been An experimental pre and post control group design study was carried out on increasing the dose of calcium tablets in 28-36 weeks pregnant women with an increase in blood pressure, which was carried out at the Obstetrics Clinic at the Dr. M. Djamil Padang and several private midwife practice places in the Municipality of Padang during the period July 2013 - April 2014. During the study a sample of 101 people were obtained, but 40 people were included in the research criteria. For the treatment of getting a calcium tablet 3 x 500 mg, while the control getting a calcium tablet 1 x 500 mg, given every month until delivery.

Effect of Calcium Giving against Systolic Blood Pressure

A. Treatment Group (3x500 mg/day)

Table 1. Effect of calcium administration on systolic blood pressure in the treatment group.

Variable	Mean ± SD	p-value
Systolic Blood Pressure before administration of calcium	121,4 ± 5,62	0,874
Systolic Blood Pressure after administration of calcium	121,5 ± 8,02	

In the treatment group it can be seen that average systolic blood pressure before administration of calcium was slightly lower than systolic blood pressure after administration of calcium (121.4 ± 5.62: 121.5 ± 8.02). There was no statistically significant difference between systolic blood pressure before and after administration of calcium in the treatment group (p> 0.05).

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B. Control Group (1x500 mg/day)

Table 2. Effect of calcium administration on systolic blood pressure in the control group.

Variable	Mean ± SD	p-value
Systolic Blood Pressure before administration of calcium	122,7 ± 10,42	0,605
Systolic Blood Pressure after administration of calcium	121,5 ± 6,71	

In the control group it can be seen that average systolic blood pressure before administration of calcium is higher than systolic blood pressure after administration of calcium (122.7 ± 10.42: 121.5 ± 6.71). But there was no statistically significant difference between systolic blood pressure before and after administration of calcium in the control group (p> 0.05).

Differences in Effect of Calcium Administration on Systolic Blood Pressure in Both Groups

Table 3. Differences in the effect of calcium administration on systolic blood pressure in the two groups

Group	Mean ± SD	p-value
Treatment	121,5 ± 8,02	1
Control	121,5 ± 6,71	

In the control and treatment groups it can be seen that the average systolic blood pressure after administration of calcium is the same (121.5 ± 8.02: 121.5 ± 6.71). But statistically there isn't significant difference between systolic blood pressure after administration of calcium in both groups (p> 0.05).

Effect of Calcium Giving against Diastolic Blood Pressure

A. Treatment Group (3x500 mg/day)

Table 4. Effect of calcium administration on diastolic blood pressure in the treatment group.

Variable	Mean ± SD	p-value
Diastolic Blood Pressure before administration of calcium	77,1 ± 5,37	0,959
Diastolic Blood Pressure after administration of calcium	77,2 ± 6,46	

In the treatment group it can be seen that the mean diastolic blood pressure before calcium administration is slightly lower than the diastolic blood pressure after calcium administration (77.1 ± 5.37 : 77.2 ± 6.46). But statistically there was no significant difference between diastolic blood pressure before and after calcium administration in the treatment group (p> 0.05).

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B. Control Group (1x500 mg/day)

Table 5. Effect of calcium administration on diastolic blood pressure in the control group.

Variable	Mean ± SD	p-value
Diastolic Blood Pressure before administration of calcium	73,5 ± 6,04	0,063
Diastolic Blood Pressure after administration of calcium	75,9 ± 4,32	

In the control group, it can be seen that the average diastolic blood pressure before calcium administration is lower than the diastolic blood pressure after calcium administration (73.5 ± 6.04 : 75.9 ± 4.32). But statistically there was no significant difference between diastolic blood pressure before and after calcium administration in the control group (p> 0.05).

Differences in the Effect of Calcium Administration on Diastolic Blood Pressure in Both Groups

Table 6. Differences in the effect of administration of calcium on diastolic blood pressure in the two group

Group	Mean ± SD	p-value
Treatment	77,2 ± 6,46	0,460
Control	75,9 ± 4,32	

In the control group it can be seen that the average diastolic blood pressure after administration of calcium is lower than the diastolic blood pressure of the treatment (75.9 ± 4.32: 75.9 ± 4.32). But there was no statistically significant difference between diastolic blood pressure after administration of calcium in both groups (p> 0.05).

Effect of Calcium Administration on MAP

A. Treatment Group (3x500 mg/day)

Table 7. Effect of calcium administration on MAP in the treatment group.

Variable	Mean ± SD	p-value
MAP before administration of calcium	91,859 ± 4,50	0,904
MAP after administration of calcium	91,956 ± 6,08	

In the treatment group it can be seen that the average MAP pressure before administration of calcium is slightly lower than the MAP after administration of calcium (91,859 ± 4,50 : 91,956 ± 6,08). But statistically there was no significant difference between MAP before and after administration of calcium in the treatment group (p> 0.05).

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B. Control Group (1x500 mg/day)

Table 8. Effect of calcium administration on MAP in the control group.

Variable	Mean ± SD	p-value
MAP before administration of calcium	89,896 ± 4,81	0,296
MAP after administration of calcium	91,088 ± 4,47	

In the control group it can be seen that the average MAP before administration of calcium is lower than the MAP after administration of calcium (89,896 ± 4.81: 91,088 ± 4.47). But in a manner there were no statistically significant differences between MAP before and after administration of calcium in the control group (p> 0.05).

Differences in Effects of Giving Calcium on MAP in Both Groups

Table 9. Differences in the effect of administration of calcium on MAP in the two group

Group	Mean ± SD	p-value
Treatment	91,956 ± 6,08	0,610
Control	91,088 ± 4,47	

In the control group it can be seen that the average MAP after calcium administration is lower than the MAP treatment (91,956 ± 6,08: 91,088 ± 4,47). But statistically there was no significant difference between MAP after calcium administration in the two groups (p> 0.05).

DISCUSSION

In the results of this study there was no increase in blood pressure in the treatment group or the control group. So there is an effect of giving calcium to pregnant women with a risk of blood pressure even though it is not statistically significant. In contrast to research led by researcher Pranom Buppasiri, MD, from the department of obstetrics and gynecology at Khon Kaen University in Thailand in 2011, which showed that calcium supplements did not help in the prevention of preeclampsia. Whereas in the study conducted by Parul Singla, et al in India in 2012 14 and Kawasaki et al, where in the study found the effect of giving calcium to the incidence of preeclampsia. As we know that a low calcium intake will cause an increase in blood pressure by stimulating the release of parathyroid hormone and / or renin, therefore an increase in intracellular calcium in the smooth muscle of the blood vessels will cause vasoconstriction. food in all samples, in order to rule out the existence of bias from other factors that affect calcium levels in the body conducted research. The body's absorption of calcium is also influenced by vitamin D in the body. in order to get rid of the bias of other factors that affect calcium levels in the body conducted research. The body's absorption of calcium is also influenced by vitamin D in the body. in order to get rid of the bias of other factors that affect calcium levels in the body conducted research. The body's absorption of

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calcium is the effect of calcium administration on systolic blood pressure in the treatment group can be seen that the average systolic blood pressure before administration of calcium is slightly lower than the systolic blood pressure after administration of calcium tablets (121.4 ± 5.62: 121.5 ± 8.02). Statistically there are no significant differences between systolic blood pressure before and after administration of calcium in the treatment group And the effect of giving calcium against systolic blood pressure in the group also influenced by vitamin D in the body.

The effect of calcium administration on systolic blood pressure in the treatment group can be seen that the mean systolic blood pressure before calcium administration is slightly lower than the systolic blood pressure after calcium tablet administration (121,4 ± 5,62 : 121,5 ± 8,02). There was no statistically significant difference between systolic blood pressure before and after calcium administration in the treatment group (p>0,05). And the effect of calcium administration on systolic blood pressure in the control group can be seen that the average systolic blood pressure before calcium administration is higher than the systolic blood pressure after calcium administration (122.7 ± 10.42 : 121.5 ± 6.71) . However, statistically there was no significant difference between systolic blood pressure before and after calcium administration in the control group (p> 0.05). While the difference in the effect of calcium administration on systolic blood pressure, it can be seen that the mean systolic blood pressure after calcium administration is the same in both groups (121.5 ± 8.02 : 121.5 ± 6.71). But statistically there was no significant difference between systolic blood pressure after calcium administration in the two groups (p> 0.05). In accordance with previous studies on the relationship between calcium ion levels and hypertension in pregnancy, the results were different. Paul Singla et al (2012) found that systolic blood pressure increased in control and decreased slightly in the treatment group.[14] Reitz (1977) found that serum calcium ion levels in pregnant women would increase, while Pitkin (1979) had the opposite result, namely that pregnancy would increase. significantly reduce serum calcium ion levels. This contradicts another study conducted by McCarron in 1983 by taking secondary data from the Health and Nutrition Examination Survey (HANES) I in the United States. From this study, it was found that the amount of calcium consumed by hypertensive sufferers was 18% lower than normal people.[16] Theoretically, calcium ion deficiency can cause cell membrane disorders resulting in accumulation of calcium ions in cells. When an increase in calcium ion levels in cells occurs in the heart muscle and smooth muscle of blood vessels, there will be an increase in muscle tone and will eventually lead to an increase in blood pressure.[17]

The effect of calcium administration on diastolic blood pressure in the treatment group can be seen that the mean diastolic blood pressure before calcium administration is slightly lower than the diastolic blood pressure after calcium administration (77.1 ± 5.37: 77.2 ± 6.46). There was no statistically significant difference between diastolic blood pressure before and after calcium administration in the treatment group (p> 0.05). And the effect of calcium

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administration on diastolic blood pressure in the control group can be seen that the mean diastolic blood pressure before calcium administration is lower than the diastolic blood pressure after calcium administration (73.5 ± 6,04: 75,9 ± 4,32). There was no statistically significant difference between diastolic blood pressure before and after calcium administration in the control group (p> 0.05). While the difference in the effect of calcium administration on diastolic blood pressure in the two groups, it can be seen that in the control group the average diastolic blood pressure after calcium administration was lower than the treated diastolic blood pressure (75.9 ± 4.32: 75.9 ± 4.32). But statistically there was no significant difference between diastolic blood pressure after calcium administration in the two groups (p> 0.05). This is different from research in 1986, where Grobbee and Hofman conducted a study by providing calcium supplementation as much as 1 g / day for 12 weeks, it turned out that there was a decrease in diastolic blood pressure in patients with mild hypertension, supported by research conducted by Belizan et al. where normotensive pregnant women were divided into 2 groups. The two groups were given calcium supplementation as much as 1 g and 2 g per day respectively during pregnancy. The results of this study indicated that the levels of serum calcium ions in the two groups were not significantly different, but there was a significant difference in the decrease in diastolic blood pressure.[16] Paul Singla et al (2012) found that diastolic blood pressure increased in both groups.[14] In theory, it is said that under normal conditions, the concentration of calcium ions in the plasma smooth muscle cells is 10^{-7}-10^{-8} mol / L. Smooth muscle will experience relaxation when the concentration of calcium ions is less than 10^{-7} mol / L, conversely, if the concentration is above normal, the smooth muscle of the blood vessels becomes very reactive, causing increased tone, and ultimately an increase in blood pressure. In this study, where no significant results were found, it could be caused by the mother's calcium intake and the lack of proper assessment of calcium during pregnancy, as well as the fact that the body's ability of each individual is different in absorption of calcium. it can be influenced by the acidity of the duodenum.

The effect of calcium administration on MAP in the treatment group can be seen that the average MAP pressure before calcium administration is lower than that of MAP after calcium administration (91,859 ± 4.50: 91,956 ± 6,08). Statistically there was no significant difference between MAP before and after calcium administration in the treatment group (p> 0.05). And the effect of calcium administration on MAP in the control group can be seen that the average MAP before calcium administration is lower than that of MAP after calcium administration (89,896 ± 4,81: 91,088 ± 4,47). There was no statistically significant difference between MAP before and after calcium administration in the control group (p> 0.05). While the difference in the effect of calcium administration on MAP in the two groups, it appears that the control group's average MAP after calcium administration is lower than the MAP treatment (91.088 ± 4.47: 91.956 ± 6.08). But statistically there was no significant difference

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between MAP after calcium administration in the two groups (p> 0.05). This is consistent with a study conducted by Johnson et al in 1985 by providing calcium supplementation as much as 1.5 g / day for 4 years in normal women and women with hypertension. After 4 years of observation, there was no decrease in systolic or diastolic blood pressure in normal women, whether they received supplementation or not. Supported by research to see the relationship between calcium consumption and blood pressure was also conducted by Sowers et al. in 1985. In fact, no significant relationship was found in the young women group, but in the older women group there was a significant inverse relationship between the two. In contrast to the research conducted by Epri Wigunarto at the Dagang Madium Community Health Center, where there was a decrease in blood pressure in pregnant women in the second and third trimesters by giving calcium tablets for 28 days, both systolic and diastolic blood pressure. Increased levels of parathyroid hormone in serum will cause an increase in calcium ion levels in cells through 2 mechanisms, namely (1) increased cell permeability to calcium ions and (2) activation of adenyl cyclase and increased cyclic adenosine monophosphate (cAMP) which will free calcium ions from mitochondria. into the cytosol. Furthermore, the concentration of calcium ions in vascular smooth muscle cells will increase the sensitivity of these cells to pressure substances so that vasoconstriction easily occurs which will increase peripheral resistance and ultimately result in an increase in blood pressure.[18] Gant, in Repke and Villar (1991), and Bourdeau (1994) argued that the sensitivity of vascular smooth muscle is influenced by the concentration of serum calcium ions through the renin – angiotensin axis. Renin is released by the kidney glomerular juksta when the serum calcium ion level decreases and vice versa. Thus, blood pressure is influenced directly by serum calcium ion levels and indirectly through the renin – angiotensin axis. The difference from the results of the above research shows that calcium is not the only factor that can affect the fluctuation of blood pressure, but there are also hormonal factors such as paratyroid hormone and renin angiotensin factor. Besides that, the absorption factor of the body itself against calcium, it can be influenced by the digestive tract factors of each individual. The absorption of calcium is also greatly influenced by the presence of vitamin D, therefore the body's need for vitamin D should also be considered. So in general it appears that there is an effect of calcium administration in pregnant women at risk on blood pressure, although it is not statistically significant.

CONCLUSION

There was no effect of giving calcium tablets on systolic or diastolic blood pressure between the treatment and control groups. There was no effect of giving calcium tablets on MAP between the treatment and control groups.

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